

NIST's Recommendations Following the Federal Building and Fire Investigation of the World Trade Center Disaster

Status of the Recommendations

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| <p>Recommendation 1. NIST recommends that: (1) progressive collapse be prevented in buildings through the development and nationwide adoption of consensus standards and code provisions, along with the tools and guidelines needed for their use in practice; and (2) a standard methodology be developed—supported by analytical design tools and practical design.</p> | <p><i>Affected Standards:</i> ASCE-7, AISC Specifications, and ACI 318. These standards and other relevant committees should draw on expertise from ASCE/SFPE 29 for issues concerning progressive collapse under fire conditions. <i>Model Building Codes:</i> The consensus standards should be adopted in model building codes (i.e., the <i>International Building Code</i> and NFPA 5000) by mandatory reference to, or incorporation of, the latest edition of the standard. State and local jurisdictions should adopt and enforce the improved model building codes and national standards based on all 30 WTC recommendations. The codes and standards may vary from the WTC recommendations, but satisfy their intent.</p> | <p><u>NIBS:</u> The ICC AHC-TRB submitted an IBC change proposal concerning Disproportionate Collapse. The NIBS/MMC committee will consider the final wording of this proposal before the September ICC hearings and decide whether to formally support it.</p> <p><u>ASCE:</u> Plans to develop new standard and is in the process of forming a technical committee; NIST staff will participate.</p> <p><u>NIST:</u> Multi-year NIST project to support the development of performance criteria, prediction tools, and practical guidance for prevention of progressive collapse. NIST is working through AISC TC 3, Loads, Analysis, & Systems, to provide NIST report on Comparison of Existing Design Standards on Progressive Collapse for consideration.</p> <p><u>NFPA:</u> Recommends that expert groups such as ASCE, NCSEA or a combination of the two work towards development of a guideline document. Once available,</p> |

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| | | <p>NFPA 5000 would consider referencing such a guidance document. NFPA will consider making this a formal recommendation to ASCE or NCSEA via the NFPA High Rise Building Safety Advisory Committee (HRBSAC). NFPA is expected to brief the committee on its efforts related to this and other recommendations at the NIBS/MMC committee meeting on May 2.</p> |
| <p>Recommendation 2. NIST recommends that nationally accepted performance standards be developed for: (1) conducting wind tunnel testing of prototype structures based on sound technical methods that result in repeatable and reproducible results among testing laboratories; and (2) estimating wind loads and their effects on tall buildings for use in design, based on wind tunnel testing data and directional wind speed data.</p> | <p><i>Affected National Standard:</i> ASCE-7. <i>Model Building Codes:</i> The standard should be adopted in model building codes by mandatory reference to, or incorporation of, the latest edition of the standard.</p> | <p><u>NIBS:</u> The ICC CTC submitted an IBC change proposal to reference the new ASCE standard -- see Code Change Proposals on:</p> <ul style="list-style-type: none"> • Determination of Wind Loads and Wind Tunnel Testing • Special Inspections of Spray-Applied Fire Resistive Materials • Structural Frame Approach to Fire Resistance Ratings <p><u>ASCE:</u> A wind load testing standard that addresses the first part of the recommendation is being balloted by ASCE. (NIST staff have reviewed ASCE wind tunnel testing draft standard, and have provided the comments to the NIBS/MMC committee for their</p> |

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| | | <p>consideration.)</p> <p><u>NFPA</u>: Recommended that expert groups such as ASCE, NCSEA or a combination of the two work towards development of a guideline document. Once available, NFPA 5000 would consider referencing such a guidance document. NFPA will consider making this a formal recommendation to ASCE or NCSEA via the NFPA High Rise Building Safety Advisory Committee (HRBSAC). NFPA is expected to brief the committee on its efforts related to this and other recommendations at the NIBS/MMC committee meeting on May 2.</p> <p><u>NIST</u>: Plans to work with ASCE to upgrade the standard to include standardized methods of wind load estimation from wind tunnel testing. Multi-year NIST project to support the development of prediction methodologies for wind loads estimation in next-generation standards.</p> |
| <p>Recommendation 3. NIST recommends that an appropriate criterion be developed and implemented to enhance the performance of tall buildings by limiting how much they sway under lateral load</p> | <p><i>Affected National Standards:</i> ASCE-7, AISC Specifications, and ACI 318. <i>Model Building Codes:</i> The standards should be adopted in model building codes by mandatory reference to, or</p> | <p><u>NIBS</u>: Not directly an <i>IBC</i> issue but rather an AISC, ACI, ASCE 7 issue. NIBS committee wrote to ASCE staff and ASCE 7 chair encouraging that the issue be addressed in the near-term and that the</p> |

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| design conditions (e.g., winds and earthquakes). | incorporation of, the latest edition of the standard. | <p>committee be involved in that process. The NIBS/MMC committee hopes to receive an update on ASCE/SEI plans, at or before the May 2 meeting.</p> <p><u>NIST:</u> Consulted with major design firms and reviewed designs of 36 buildings to tabulate range of drift ratios found in common practice. NIST is working with ASCE Committee on Design of Steel Building Structures to address Practices related to Design of Steel Buildings under Wind Loads.</p> <p><u>NFPA:</u> Recommended that expert groups such as ASCE, NCSEA or a combination of the two work towards development of a guideline document. Once available, NFPA 5000 would consider referencing such a guidance document. Current drift limit criteria for seismic design as well as serviceability issues should be considered when any changes are suggested by ASCE/NCSEA. NFPA will consider making this a formal recommendation to ASCE or NCSEA via the NFPA High Rise Building Safety Advisory Committee (HRBSAC). NFPA is expected to brief the committee on its efforts related to this and other recommendations at the NIBS/MMC committee meeting on May 2.</p> |

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| <p>Recommendation 4. NIST recommends evaluating, and where needed improving, the technical basis for determining appropriate construction classification and fire rating requirements (especially for tall buildings)—and making related code changes now as much as possible—by explicitly considering factors including:</p> <ul style="list-style-type: none"> • timely access by emergency responders and full evacuation of occupants, or the time required for burnout without partial collapse; • the extent to which redundancy in active fire protection (sprinkler and standpipe, fire alarm, and smoke management) systems should be credited for occupant life safety;²⁴ • the need for redundancy in fire protection systems that are critical to structural integrity;²⁵ • the ability of the structure and local floor systems to withstand a maximum credible fire scenario²⁶ without collapse, recognizing that sprinklers could be compromised, not operational, or non-existent; • compartmentation requirements (e.g., 12,000 ft² (27)) to protect the structure, including fire rated doors and automatic enclosures, and limiting air supply (e.g., thermally resistant window assemblies) to | <p><i>Model Building Codes:</i> A comprehensive review of current construction classification and fire rating requirements and the establishment of a uniform set of revised thresholds with a firm technical basis that considers the factors identified above should be undertaken.</p> | <p><u>NIBS</u>: The ICC AHC-TRB submitted an IBC change proposal - see Survival of a Building Contents Fire Without Collapse. The NIBS/MMC committee will consider the final wording of this proposal before the September ICC hearings and decide whether to formally support it.</p> <p><u>NFPA</u>: The NFPA High Rise Building Safety Advisory Committee (HRBSAC) is considering a categorization process for high rise buildings. HRBSAC is also working to determine what enhanced or redundant features may be necessary based on this resultant categorization process. NFPA committees will also be closely reviewing the WTC 7 report as it relates to Bullet Item 6. NFPA is expected to brief the committee on its efforts related to this and other recommendations at the NIBS/MMC committee meeting on May 2.</p> |

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| <p>retard fire spread in buildings with large, open floor plans;</p> <ul style="list-style-type: none"> the effect of spaces containing unusually large fuel concentrations for the expected occupancy of the building; and the extent to which fire control systems, including suppression by automatic or manual means, should be credited as part of the prevention of fire spread. | | |
| <p>Recommendation 5. NIST recommends that the technical basis for the century-old standard for fire resistance testing of components, assemblies, and systems be improved through a national effort. Necessary guidance also should be developed for extrapolating the results of tested assemblies to prototypical building systems. A key step in fulfilling this recommendation is to establish a capability for studying and testing the components, assemblies, and systems under realistic fire and load conditions.</p> | <p><i>Affected National and International Standards:</i> ASTM E 119, NFPA 251, UL 263, and ISO 834. <i>Model Building Codes:</i> The standards should be adopted in model building codes by mandatory reference to, or incorporation of, the latest edition of the standard.</p> | <p><u>NIBS:</u> The NIBS Building Code Experts will support efforts to change ASTM E119 and related Underwriters Laboratories (UL) and National Fire Protection Association (NFPA) standards. At or before its May 2 meeting, the NIBS/MMC committee hopes to receive an update on the standards development efforts of ASTM, NFPA, et al.</p> <p><u>NIST:</u> Will develop and present proposed changes to the standard for consideration by ASTM, NFPA, UL, and ISO.</p> <p><u>ASTM:</u> International Subcommittee E05.11 on Fire Resistance began addressing this recommendation concerning changes to ASTM standard E 119 in December 2005. It is expected that committee balloting will start in April 2006</p> |

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| | | <p>and the results discussed at the June 11-14, 2006 meetings.</p> <p><u>NFPA</u>: The Fire Protection Research Foundation (FPRF) of the NFPA is working along side the ASTM E 5 process to complete a literature review and to begin an evaluation process. The first meeting for this effort is scheduled for 3 March 2006. NFPA is expected to brief the committee on its efforts related to this and other recommendations at the NIBS/MMC committee meeting on May 2.</p> |
| <p>Recommendation 6. NIST recommends the development of criteria, test methods, and standards: (1) for the in-service performance of sprayed fire-resistive materials (SFRM, also commonly referred to as fireproofing or insulation) used to protect structural components; and (2) to ensure that these materials, as-installed, conform to conditions in tests used to establish the fire resistance rating of components, assemblies, and systems.</p> | <p><i>Affected Standards:</i> AIA MasterSpec and AWCI Standard 12 for field inspection and conformance criteria; ASTM standards for SFRM performance criteria and test methods. <i>Model Building Codes:</i> The standards should be adopted in model building codes by mandatory reference to, or incorporation of, the latest edition of the standard. (See Recommendation 10 for more on this issue.)</p> | <p><u>NIBS</u>: The ICC CTC submitted an IBC change proposal to improve the performance of sprayed fire-resistant materials - see Code Change Proposals on:</p> <ul style="list-style-type: none"> • Determination of Wind Loads and Wind Tunnel Testing • Special Inspections of Spray-Applied Fire Resistive Materials • Structural Frame Approach to Fire Resistance Ratings. <p>The ICC AHC-TRB submitted three IBC change proposals addressing various aspects of this recommendation - see Bond Strength Requirements for Spray-</p> |

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| | | <p><u>Applied Fire Resistive Materials in Tall Buildings; In-Place Durability of Spray-Applied Fire Resistive Materials</u> and <u>Special Inspections Required for Spray-Applied Fire Resistive Materials</u>. The NIBS/MMC committee will consider the final wording of these proposals before the September ICC hearing and decide whether to formally support them. Also, cost and performance data will be gathered if possible prior to that time.</p> <p><u>NFPA</u>: Technical Committees are expected to review proposals that will mandate conformance with field inspection/ quality control issues from groups like AWCI and FCIA. NFPA is expected to brief the committee on its efforts related to this and other recommendations at the NIBS/MMC committee on its efforts related to this and other recommendations at the NIBS/MMC committee meeting on May 2.</p> <p><u>ASTM</u>: International Committee E06 on Performance of Buildings will address this recommendation and other related SFRM recommendations before and during their upcoming April 23-26, 2006 meetings.</p> <p><u>NIST</u>: Developing proposals for improvement to in-service inspection</p> |

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| | | standards of SFRM for consideration by AWCI and ASTM. NIST will write paper for ICC Journal on use of intumescent coatings for fire protection. NIST is forming an industry consortium to develop the test methods, measure performance, and determine in-service performance criteria for fire protective coating materials. |
| <p>Recommendation 7. NIST recommends the adoption and use of the “structural frame” approach to fire resistance ratings.</p> | <p>This approach is currently required by the <i>International Building Code (IBC)</i>, one of the model codes, and was incorporated into the 2006 edition of NFPA 5000, Building Construction and Safety Code. This requirement ensures consistency in the fire protection provided to all of the structural elements that contribute to overall structural stability. State and local jurisdictions should adopt and enforce this requirement.</p> | <p><u>NIBS</u>: The ICC CTC submitted an IBC change proposal to address the structural frame approach to fire resistance ratings – see Code Change Proposals on:</p> <ul style="list-style-type: none"> • Determination of Wind Loads and Wind Tunnel Testing • Special Inspections of Spray-Applied Fire Resistive Materials • Structural Frame Approach to Fire Resistance Ratings. <p>The NIBS/MMC committee will consider the final wording of this proposal before the September ICC hearings and decide whether to formally support it</p> <p><u>NFPA</u>: The structural frame approach is mandated in the 2006 edition of NFPA 5000. NFPA is expected to brief the committee on its efforts related to this and</p> |

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| | | other recommendations at the NIBS/MMC committee meeting on May 2. |
| <p>Recommendation 8. NIST recommends that the fire resistance of structures be enhanced by requiring a performance objective that uncontrolled building fires result in burnout without partial or global (total) collapse.</p> | <p><i>Model Building Codes:</i> This recommendation should be included into the national model codes as an objective and adopted as an integral part of fire resistance design for structures. The issue of non-operational sprinklers could be addressed using the existing concept of Design Scenario 8 of NFPA 5000, where such compromise is assumed and the result is required to be acceptable to the Authority Having Jurisdiction.</p> <p><i>Affected Standards:</i> ASCE-7, AISC Specifications, ACI 318, and ASCE/SFPE 29.</p> | <p><u>NIBS:</u> <u>NIBS:</u> The ICC AHC-TRB submitted an IBC change proposal - see <u>Survival of a Building Contents Fire Without Collapse</u>. The NIBS/MMC committee will consider the final wording of this proposal before the September ICC hearings and decide whether to formally support it.</p> <p><u>NFPA:</u> NFPA Technical Committees are likely to parse this recommendation to distinguish between local collapse and global collapse. Performance Based Design (PBD) options already contained in NFPA 101 and NFPA 5000 address the possibility of non-functioning/available systems or features. NFPA supports the adoption of more formal guidance to establish performance criteria and relevant guidelines or information.</p> <p><u>NIST:</u> Will develop code change proposal to enhance criteria for compartment area and ventilation as an interim measure for the March 2006 deadline for the IBC supplement. Multi-year NIST project to support the development of performance objectives, criteria, evaluation methods,</p> |

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| | | prediction tools, and practical guidance for fire resistance design and retrofit of structures. NIST is working with AISC TC 8 Design for Fire Conditions to implement performance-based approach to steel design. |
| <p>Recommendation 9. NIST recommends the development of: (1) performance-based standards and code provisions, as an alternative to current prescriptive design methods, to enable the design and retrofit of structures to resist real building fire conditions, including their ability to achieve the performance objective of burnout without structural or local floor collapse; and (2) the tools, guidelines, and test methods necessary to evaluate the fire performance of the structure as a whole system.</p> | <p><i>Affected National and International Standards:</i> ASCE-7, AISC Specifications, ACI 318, and ASCE/SFPE 29 for fire resistance design and retrofit of structures; NFPA, SFPE, ASCE, and ISO TC92 SC4 for building-specific multi-compartment, multi-floor design basis fire scenarios; and ASTM, NFPA, UL, and ISO for new test methods. <i>Model Building Codes:</i> The performance standards should be adopted as an alternate method in model building codes by mandatory reference to, or incorporation of, the latest edition of the standard.</p> | <p><u>NIBS:</u> The NIBS Building Code Experts support the performance-based design concept and will bring together various interests to identify gaps with respect to evaluation tools and to develop a detailed action plan (with estimated costs) for filling those gaps. Three national standards (ASCE/SFPE 29, ACI 216, and AISC Specifications) have incorporated first-generation performance-based methods, as an alternative to current prescriptive methods, to enable the design and retrofit of structures to resist building fires. These methods are limited to standard (not real) fires.</p> <p><u>NFPA:</u> Technical Committees are likely to parse this recommendation to distinguish between local collapse and global collapse. PBD options already in NFPA 101 and NFPA 5000 address the possibility of non-functioning/available systems or features. NFPA supports the adoption of more formal guidance to establish</p> |

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| | | <p>performance criteria and relevant guidelines or information.</p> <p><u>ASTM:</u> Various committees in ASTM International have been addressing the issue of performance-based methods. These discussions will continue at the April, May and June Committee Weeks.</p> <p><u>NIST:</u> NIST is working with AISI, AISC, and other industry groups to support the development of performance-based standards for fire resistance design and retrofit of structures. Multi-year NIST project to support the development of performance objectives, criteria, evaluation methods, prediction tools, and practical guidance for fire resistance design and retrofit of structures.</p> |
| <p>Recommendation 10. NIST recommends the development and evaluation of new fire-resistive coating materials, systems, and technologies with significantly enhanced performance and durability to provide protection following major events.</p> | <p><i>Affected Standards:</i> Technical barriers, if any, to the introduction of new structural fire resistance materials, systems, and technologies should be identified and eliminated in the AIA MasterSpec, AWCI Standard 12 and ASTM standards for field inspection, conformance criteria, and test methods. <i>Model Building Codes:</i> Technical barriers, if any, to the introduction of new structural fire resistance materials, systems, and</p> | <p><u>NIBS:</u> Not directly a code matter but NIBS Building Code Experts will develop a plan for looking at new materials and facilitating their testing and use.</p> <p><u>ASTM:</u> International Committee E06 on Performance of Buildings will address this recommendation before and during their upcoming April 23-26, 2006 meetings.</p> <p><u>NIST:</u> NIST has formed an industry</p> |

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| | technologies should be eliminated from the model building codes. | consortium to develop the test methods, measure performance, and determine in-service performance criteria for fire protective coating materials. NIST multi-year project to assess the performance of current spray-applied and intumescent fire protective materials and to support the development of new standards. NIST will write paper for ICC Journal on use of intumescent coatings for fire protection. |
| <p>Recommendation 11. NIST recommends that the performance and suitability of advanced structural steel, reinforced and pre-stressed concrete, and other high-performance material systems be evaluated for use under conditions expected in building fires.</p> | <p><i>Affected Standards:</i> AISC Specifications and ACI 318. Technical barriers, if any, to the introduction of these advanced systems should be eliminated in ASTM E 119, NFPA 251, UL 263, ISO 834.</p> <p><i>Model Building Codes:</i> Technical barriers, if any, to the introduction of these advanced systems should be eliminated from the model building codes.</p> | <p><u>NIBS:</u> Not directly a code matter but NIBS Building Code Experts will develop a plan for looking at new materials and facilitating their testing and use.</p> <p><u>NIST:</u> Project to determine the in-service performance properties of high temperature steels and compile property database.</p> <p><u>NFPA:</u> Will forward the relevant information to the NFPA Fire Test Committee for further consideration.</p> <p><u>ASTM:</u> Has established a joint task group under subcommittees A01.13 (Mechanical and Chemical Testing and Processing Methods of Steel Products and Processes) and E28.10 (Mechanical Testing: Effect of Temperature and Stress Relaxation) to define fire resistant steels and develop a</p> |

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| | | <p>standard material test method for fire resistance of such steels. This task group has been asked to provide a status report by March 31, 2006.</p> |
| <p>Recommendation 12. NIST recommends that the performance and possibly the redundancy of active fire protection systems (sprinklers, standpipes/hoses, fire alarms, and smoke management systems) in buildings be enhanced to accommodate the greater risks associated with increasing building height and population, increased use of open spaces, high-risk building activities, fire department response limits, transient fuel loads, and higher threat profile.</p> | <p><i>Affected Standards:</i> NFPA 13, NFPA 14, NFPA 20, NFPA 72, NFPA 90A, NFPA 92A, NFPA 92B, and NFPA 101. <i>Model Building Codes:</i> The performance standards should be adopted in model building codes by mandatory reference to, or incorporation of, the latest edition of the standard.</p> | <p><u>NIBS:</u> The ICC AHC-TRB submitted an IBC change proposal related to redundancy – see Reliability of Fire Suppression Systems in Tall Buildings. The ICC AHC-TRB also submitted an IBC change proposal related to special fire loads (fuel oil storage and piping) that, while not directly related to this recommendation is associated with it – see Storage and Distribution of Fuels in Buildings. The NIBS/MMC committee will consider the final wording of these proposals before the September ICC hearings and decide whether to formally support them.</p> <p><u>NFPA:</u> The NFPA High Rise Building Safety Advisory Committee (HRBSAC) is considering a categorization process for high rise buildings. HRBSAC is working to determine what enhanced or redundant features may be necessary based on this any new high rise building categories. Also related to this HRBSAC proposal is to develop the Leadership in Life Safety Design (LLSD) approach. This</p> |

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| | | <p>process will look at resource documents such as the CTBUH <i>Building Enhancement Guidelines</i> and apply a point scoring system for enhancements that go above minimum code mandated criteria. NFPA is expected to brief the committee on its efforts related to this and other recommendations at the NIBS/MMC committee meeting on May 2.</p> <p><u>NIST</u>: Has formed a consortium with NEMA 3SB to develop active surveillance technologies to enhance the reliability of sprinkler systems. The methods would form the basis for code change proposals. NIST is collaborating with the fire alarm industry, through a consortium with NEMA, to develop new technologies and features for fire alarm systems that provide active surveillance and automated testing of fire safety systems and components keyed to primary modes of failure in order to provide maximum operational reliability</p> |
| <p>Recommendation 13. NIST recommends that fire alarm and communications systems in buildings be developed to provide continuous, reliable, and accurate information on the status of life safety conditions at a level of detail sufficient to</p> | <p><i>Affected Standards:</i> NFPA 1, NFPA 72, and NFPA 101. <i>Model Building and Fire Codes:</i> The performance standards should be adopted in model building and fire codes by mandatory reference to, or incorporation of, the latest edition of the</p> | <p><u>NIBS</u>: The ICC AHC-TRB submitted an IBC code change proposal related to this recommendation as well as Recommendations 13, 14, 15, 24 – see <u>Emergency Command Centers</u>. The NIBS/MMC committee will consider the</p> |

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| <p>manage the evacuation process in building fire emergencies; all communication and control paths in buildings need to be designed and installed to have the same resistance to failure and increased survivability above that specified in present standards.</p> | <p>standard.</p> | <p>final wording of this proposal before the September ICC hearings and decide whether to formally support it.</p> <p><u>NFPA</u>: The NFPA 72 Committee will work to incorporate appropriate technologies when they are further developed. The 2007 edition of NFPA 72 (available September 2006) has accepted proposals and comments to recognize exit marking audible notification appliances. NFPA is expected to brief the committee on its efforts related to this and other recommendations at the NIBS/MMC committee meeting on May 2.</p> <p><u>NIST</u>: The Department of Homeland Security has asked NIST to develop specifications and protocols that will enable fire/emergency command stations in buildings to accept and interpret a larger quantity of more reliable information from the active fire protection (e.g., sprinklers, fire alarm, smoke management) systems for purposes of providing tactical decision aids to fireground commanders (#14) and for managing the evacuation process (#13).</p> |
| <p>Recommendation 14. NIST recommends that control panels at fire/emergency</p> | <p><i>Affected Standards: NFPA 1, NFPA 72, and NFPA 101. Model Building and Fire</i></p> | <p><u>NIBS</u>: The ICC AHC-TRB submitted an IBC code change proposal related to this</p> |

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| <p>command stations in buildings be adapted to accept and interpret a larger quantity of more reliable information from the active fire protection systems that provide tactical decision aids to fireground commanders, including water flow rates from pressure and flow measurement devices, and that standards for their performance be developed.</p> | <p><i>Codes:</i> The performance standards should be adopted in model building and fire codes by mandatory reference to, or incorporation of, the latest edition of the standard.</p> | <p>recommendation as well as Recommendations 13, 14, 15, 24 – see Emergency Command Centers. The NIBS/MMC committee will consider the final wording of this proposal before the September ICC hearings and decide whether to formally support it.</p> <p><u>NFPA:</u> The NFPA 72 Committee will work to incorporate appropriate technologies when they are further developed. NFPA is expected to brief the committee on its efforts related to this and other recommendations at the NIBS/MMC committee meeting on May 2.</p> <p><u>NIST:</u> The Department of Homeland Security has asked NIST to develop specifications and protocols that will enable fire/emergency command stations in buildings to accept and interpret a larger quantity of more reliable information from the active fire protection (e.g., sprinklers, fire alarm, smoke management) systems for purposes of providing tactical decision aids to fireground commanders (#14) and for managing the evacuation process (#13).</p> |
| <p>Recommendation 15. NIST recommends that systems be developed and</p> | <p><i>Affected Standards:</i> NFPA 1, NFPA 72, and NFPA 101. <i>Model Building and Fire</i></p> | <p><u>NIBS:</u> The ICC AHC-TRB submitted an IBC code change proposal related to this</p> |

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| <p>implemented for: (1) real-time off-site secure transmission of valuable information from fire alarm and other monitored building systems for use by emergency responders, at any location, to enhance situational awareness and response decisions and maintain safe and efficient operations;³⁵ and (2) preservation of that information either off-site or in a black box that will survive a fire or other building failure for purposes of subsequent investigations and analysis. Standards for the performance of such systems should be developed, and their use should be required.</p> | <p><i>Codes:</i> The performance standards should be adopted in model building and fire codes by mandatory reference to, or incorporation of, the latest edition of the standard.</p> | <p>recommendation as well as Recommendations 13, 14, 15, 24 – see Emergency Command Centers. The NIBS/MMC committee will consider the final wording of this proposal before the September ICC hearings and decide whether to formally support it.</p> <p><u>NFPA:</u> The NFPA 72 Committee will work to incorporate appropriate technologies when they are further developed. The NFPA High Rise Building Safety Advisory Committee (HRBSAC) is considering a process to have real time information from the emergency scene simulcast to a remote location. NFPA is expected to brief the committee on its efforts related to this and other recommendations at the NIBS/MMC committee meeting on May 2.</p> |
| <p>Recommendation 16. NIST recommends that public agencies, non-profit organizations concerned with building and fire safety, and building owners and managers develop and carry out public education and training campaigns, jointly and on a nationwide scale, to improve building occupants’ preparedness for evacuation in case of building emergencies.</p> | <p><i>Affected Standard:</i> ICC/ANSI A117-1. <i>Model Building and Fire Codes:</i> The standard should be adopted in model building and fire codes by mandatory reference to, or incorporation of, the latest edition of the standard. <i>Affected Organizations:</i> NFPA, NIBS, NCSBCS, BOMA, and CTBUH.</p> | <p><u>NIBS:</u> A NIBS/MMC committee expert has prepared a white paper for the committee on the a state-of-the-art summary of research knowledge regarding public information campaigns for large general populations. This paper also identifies three other areas in need of similar exploration to provide the basis for a concerted effort. (see paper)</p> |

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| | | <p><u>NFPA</u>: At present, NFPA Public Education materials do address building evacuation issues. However, efforts are underway to establish an occupant response protocol that works to address other than ‘traditional’ building emergencies. The NFPA Disability Access Review and Advisory Committee (DARAC) has recommended that a guidance document for persons with disabilities be developed to address emergency procedures for persons with disabilities. A draft is currently being assembled by NFPA staff. This guide will provide a list of systems, resources and options for employers and occupants to assist those with disabilities. NFPA is expected to brief the committee on its efforts related to this and other recommendations at the NIBS/MMC committee meeting on May 2.</p> |
| <p>Recommendation 17. NIST recommends that tall buildings be designed to accommodate timely full building evacuation of occupants when required in building-specific or large-scale emergencies such as widespread power outages, major earthquakes, tornadoes, hurricanes without sufficient advanced</p> | <p><i>Affected Standards:</i> NFPA 101, ASME A 17. <i>Model Building and Fire Codes:</i> The standards should be adopted in model building and fire codes by mandatory reference to, or incorporation of, the latest edition of the standard.</p> | <p><u>NIBS</u>: The ICC AHC-TRB submitted an IBC change proposal addressing an additional exit – see Adequacy of Stair Capacity for Full Evacuation. The NIBS/MMC committee will review this proposal before the September ICC hearings and determine whether modifications are needed and/or whether it</p> |

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| <p>warning, fires, explosions, and terrorist attack. Building size, population, function, and iconic status should be taken into account in designing the egress system. Stairwell capacity and stair discharge door width³⁸ should be adequate to accommodate counterflow due to emergency access by responders.</p> | | <p>can formally support them.</p> <p><u>NFPA</u>: The 2006 editions of NFPA 101 and NFPA 5000 include requirements for 56 inch wide (minimum) stairs when an aggregate of 2000 occupants are expected to use a stair. NFPA is expected to brief the committee on its efforts related to this and other recommendations at the NIBS/MMC committee meeting on May 2.</p> <p><u>NIST</u>: Multi-year NIST project to produce new data, on occupant evacuation in stairwells, including the counterflow of emergency responders, as input to evacuation prediction models and code provisions.</p> |
| <p>Recommendation 18. NIST recommends that egress systems be designed: (1) to maximize remoteness of egress components (i.e., stairs, elevators, exits) without negatively impacting the average travel distance; (2) to maintain their functional integrity and survivability under foreseeable building-specific or large-scale emergencies; and (3) with consistent layouts, standard signage, and guidance so that systems become intuitive and obvious to building occupants during evacuations.</p> | <p><i>Affected Standard: NFPA 101. Model Building and Fire Codes:</i> The standard should be adopted in model building and fire codes by mandatory reference to, or incorporation of, the latest edition of the standard.</p> | <p><u>NIBS</u>: The ICC AHC-TRB submitted four IBC change proposals and one IFC change proposal related to this recommendation – see <u>Photoluminescent Markings in Exit Paths</u>; <u>Remoteness of Exit Stair Enclosures</u>; <u>Structural Integrity Criteria for Stair Enclosures</u>; <u>Continuity of Exit Stairs from Highest Story Served to the Level of Exit Discharge</u>; and <u>Elimination of Overhead Obstructions in Exit Paths</u>. The NIBS/MMC committee will review these proposals before the September ICC</p> |

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| | | <p>hearings and determine whether modifications are needed and/or whether it can formally support the proposals.</p> <p><u>NFPA</u>: Prior to expanding the concept of remoteness and hardened design of exits, a determination will have to be made as to what hazard scenario(s) should be contemplated beyond what is currently in the codes. The 2007 edition of NFPA 72 (available September 2006) has accepted proposals and comments to recognize exit marking audible notification appliances. NFPA is expected to brief the committee on its efforts related to this and other recommendations at the NIBS/MMC committee meeting on May 2.</p> |
| <p>Recommendation 19. NIST recommends that building owners, managers, and emergency responders develop a joint plan and take steps to ensure that accurate emergency information is communicated in a timely manner to enhance the situational awareness of building occupants and emergency responders affected by an event. This should be accomplished through better coordination of information among different emergency responder groups, efficient sharing of that information among building occupants and emergency</p> | <p><i>Affected Standard:</i> NFPA 101 and/or a new standard. <i>Model Building and Fire Codes:</i> The standard should be adopted in model building and fire codes by mandatory reference to, or incorporation of, the latest edition of the standard to the extent it is within the scope of building and fire codes.</p> | <p><u>NIBS</u>: One of the NIBS/MMC building code experts has prepared a white paper for the committee on the state-of-the-art summary of research knowledge regarding public information campaigns for large general populations. This paper also identifies three other areas in need of similar exploration to provide the basis for a concerted effort. (see paper)</p> <p><u>NFPA</u>: The 2007 edition of NFPA 72 (available September 2006) has accepted proposals and comments to recognize exit</p> |

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| <p>responders, more robust design of emergency public address systems, improved emergency responder communication systems, and use of the Emergency Broadcast System (now known as the Integrated Public Alert and Warning System) and Community Emergency Alert Networks.</p> | | <p>marking audible notification appliances. In addition, the new version has also accepted proposals and comments to recognize criteria for mass notification systems that will formalize notification criteria for large building, campus and even urban areas. The NFPA 72 Committee will work to incorporate additional and appropriate technologies when they are further developed. NFPA is expected to brief the committee on its efforts related to this and other recommendations at the NIBS/MMC committee meeting on May 2.</p> |
| <p>Recommendation 20. NIST recommends that the full range of current and next generation evacuation technologies should be evaluated for future use, including protected/hardened elevators, exterior escape devices, and stairwell descent devices, which may allow all occupants an equal opportunity for evacuation and facilitate emergency response access.</p> | <p><i>Affected Standards:</i> NFPA 101, ASME A 17, ASTM E 06, ANSI A117.1. <i>Model Building and Fire Codes:</i> The standards should be adopted in model building and fire codes by mandatory reference to, or incorporation of, the latest edition of the standard.</p> | <p><u>NFPA:</u> The 2006 editions of NFPA 101 and NFPA 5000 include requirements for the installation of stair descent devices for use by mobility impaired occupants in certain circumstances. These editions of the codes also considered use of the exterior escape devices but the recognition was not included at the end of the process. NFPA staff actively participated in the ASTM E-06 process for these devices and it is expected that new proposals for the 2009 editions of NFPA 101 and NFPA 5000 will be considered later this year. NFPA is expected to brief the committee on its efforts related to this and other recommendations at the NIBS/MMC committee meeting on May 2.</p> |

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| | | <p><u>ASTM:</u> International Committee E06 on Performance of Buildings will address this recommendation and other evacuation related issues before and during their upcoming April 23-26, 2006 meetings.</p> |
| <p>Recommendation 21. NIST recommends the installation of fire-protected and structurally hardened elevators to improve emergency response activities in tall buildings by providing timely emergency access to responders and allowing evacuation of mobility-impaired building occupants.</p> | <p><i>Affected Standards:</i> ASME A 17, ANSI 117.1, NFPA 70, NFPA 101, NFPA 1221, NFPA 1500, NFPA 1561, NFPA 1620, and NFPA 1710. <i>Model Building and Fire Codes:</i> The standards should be adopted in model building and fire codes by mandatory reference to, or incorporation of, the latest edition of the standard.</p> | <p><u>NIBS:</u> Two code change proposals were submitted to ICC for the March 24, 2006 deadline to address those recommendations: Fire Service Elevator Requirements (IBC Sections 403.10 and 3007) and Fire Service Elevator Requirements (IBC Sections 403.9 and 2702) and Illustration of Exit Stair Separation and Fire-Fighting Shafts. Current codes reference ASME A17, which requires that signs be posted by all elevators stating that elevators should not be used in an emergency. Elevators continue to operate unless a smoke alarm is triggered in either the lobby or in the machinery room, in which case they are automatically recalled to the lobby or until manually recalled by fire service personnel. A survey of fire service use of elevators has been completed. (see survey results)</p> <p><u>ASME:</u> A 17.1 task group, in partnership</p> |

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| | | <p>with the U.S. elevator industry and NIST, are working to develop specifications and operational protocols for protected elevators for fire service access and occupant egress. This work is being widely followed adoption in model building codes.</p> <p><u>GSA</u>: Has agreed to install a prototype system in a federal building as a demonstration project.</p> <p><u>NFPA</u>: Staff is very active with this project and has contributed to much of its work product. Pending completion of the required updates to ASME A17.1, major NFPA codes (NFPA 101, NFPA 5000) will evaluate the new edition of ASME A17.1. and related criteria. NFPA staff has developed preliminary draft code language based on ASME task group progress to this point. NFPA is expected to brief the committee on its efforts related to this and other recommendations at the NIBS/MMC committee meeting on May 2.</p> |
| <p>Recommendation 22. NIST recommends the installation, inspection, and testing of emergency communications systems, radio communications, and associated operating protocols to ensure that the systems and</p> | <p><i>Affected Standards:</i> FCC, SAFECOM, NFPA Standards on Electronic Safety Equipment, NFPA 70, NFPA 297, and NFPA 1221. <i>Model Building Codes:</i> The standards should be adopted in model</p> | <p><u>NIBS</u>: The ICC AHC-TRB submitted an IBC code change proposal related to this recommendation as well as Recommendations 13, 14, 15, 24 – see <u>Emergency Command Centers</u>. The</p> |

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| <p>protocols: (1) are effective for large-scale emergencies in buildings with challenging radio frequency propagation environments; and (2) can be used to identify, locate, and track emergency responders within indoor building environments and in the field.</p> | <p>building codes by mandatory reference to, or incorporation of, the latest edition of the standard.</p> | <p>NIBS/MMC committee will consider the final wording of this proposal before the September ICC hearings and decide whether to formally support it. A position paper is being planned on the intelligence aspects of information delivery for very large scale events.</p> <p><u>NFPA</u>: The NFPA High Rise Building Safety Advisory Committee (HRBSAC) is considering that broader use of supplemental antennas and/or repeaters for tall building environments to improve the communication ability of the radio equipment be integrated into building design. Such supplemental equipment may become a mandate via NFPA 72, NFPA 101, NFPA 5000 or some combination there-of. In addition, NFPA would recommend that a NIST joint project with IEEE be explored to embark on a research program to look into more robust emergency responder communication hardware and relevant software. NFPA is expected to brief the committee on its efforts related to this and other recommendations at the NIBS/MMC committee meeting on May 2.</p> |
| <p>Recommendation 23. NIST recommends the establishment and implementation of</p> | <p><i>Affected Standards:</i> National Incident Management System (NIMS), NRP,</p> | <p><u>NIBS</u>: The ICC AHC-TRB submitted an IBC code change proposal related to this</p> |

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| <p>detailed procedures and methods for gathering, processing, and delivering critical information through integration of relevant voice, video, graphical, and written data to enhance the situational awareness of all emergency responders. An information intelligence sector should be established to coordinate the effort for each incident.</p> | <p>SAFECOM, FCC, NFPA Standards on Electronic Safety Equipment, NFPA 1500, NFPA 1561, NFPA 1620, NFPA 1710, and NFPA 1221. <i>Model Building Codes:</i> The standards should be adopted in model building codes by mandatory reference to, or incorporation of, the latest edition of the standard.</p> | <p>recommendation as well as Recommendations 13, 14, 15, 24 – see Emergency Command Centers. The NIBS/MMC committee will consider the final wording of this proposal before the September ICC hearings and decide whether to formally support it.</p> <p><u>NFPA:</u> The NFPA 72 Committee will work to incorporate appropriate technologies when they are further developed. NFPA is expected to brief the committee on its efforts related to this and other recommendations at the NIBS/MMC committee meeting on May 2.</p> |
| <p>Recommendation 24. NIST recommends the establishment and implementation of codes and protocols for ensuring effective and uninterrupted operation of the command and control system for large-scale building emergencies.</p> | <p><i>Affected Standards:</i> NIMS, NRP, SAFECOM, FCC, NFPA Standards on Electronic Safety Equipment, NFPA 1221, NFPA 1500, NFPA 1561, NFPA 1620, and NFPA 1710. <i>Model Building Codes:</i> The standards should be adopted in model building codes by mandatory reference to, or incorporation of, the latest edition of the standard.</p> | <p><u>NIBS:</u> The ICC AHC-TRB submitted an IBC code change proposal related to this recommendation as well as Recommendations 13, 14, 15, 24 –see Emergency Command Centers. The NIBS/MMC committee will consider the final wording of this proposal before the September ICC hearings and decide whether to formally support it. A position paper is planned on the intelligence aspects of information delivery for very large scale events.</p> <p><u>NFPA:</u> The NFPA High Rise Building Safety Advisory Committee (HRBSAC) is</p> |

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| | | <p>considering that expansion of the available frequencies that could be used by emergency responders be explored to reduce over use of limited spectrum by emergency responders. In addition, exploratory research with related groups like IEEE should be undertaken by NIST to address this subject. NFPA is expected to brief the committee on its efforts related to this and other recommendations at the NIBS/MMC committee meeting on May 2.</p> |
| <p>Recommendation 25. Nongovernmental and quasi-governmental entities that own or lease buildings and are not subject to building and fire safety code requirements of any governmental jurisdiction are nevertheless concerned about the safety of the building occupants and the responding emergency personnel. NIST recommends that such entities be encouraged to provide a level of safety that equals or exceeds the level of safety that would be provided by strict compliance with the code requirements of an appropriate governmental jurisdiction. To gain broad public confidence in the safety of such buildings, NIST further recommends that asdesigned and as-built safety be certified by a qualified third party, independent of the building owner(s). The process should</p> | | <p><u>NIBS:</u> Jurisdictional standards of practice issue. The potential for writing to the relevant groups developing model legislation for special authorities will be explored.</p> <p><u>NIST:</u> Has shared with the NIBS Building Code Experts the statute (U.S. Code Title 40, Section 3312) containing the policy of the federal government with regard to code compliance.</p> <p><u>NFPA:</u> Is expected to brief the committee on its efforts related to this and other recommendations at the NIBS/MMC committee meeting on May 2.</p> |

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| <p>not use self-approval for code enforcement in areas including interpretation of code provisions, design approval, product acceptance, certification of the final construction, and post-occupancy inspections over the life of the buildings.</p> | | |
| <p>Recommendation 26. NIST recommends that state and local jurisdictions adopt and aggressively enforce available provisions in building codes to ensure that egress and sprinkler requirements are met by existing buildings. Further, occupancy requirements should be modified where needed (such as when there are assembly use spaces within an office building) to meet the requirements in model building codes.</p> | <p>Provisions related to egress and sprinkler requirements in existing buildings are available in such codes as the <i>International Existing Building Code (IEBC)</i>, International Fire Code, NFPA 1, NFPA 101, and ASME A 17.3.</p> | <p><u>NIBS:</u> The NIBS/MMC committee concluded that this is a long-range issue but that there needs to be a plan for addressing it incrementally. ACH-TRB plans to consider at retrofit fire issues.</p> <p><u>NFPA:</u> NFPA 101 has always contained building safety requirements that are retroactive for myriad existing building types. It requires improvements to the level of safety provided to the occupants by ignoring grandfathering concepts that are the hallmarks of other model codes.. An expansion of the NFPA 101 scope to cover other than fire type hazards or development of a separate document will be considered by NFPA. NFPA is expected to brief the committee on its efforts related to this and other recommendations at the NIBS/MMC committee meeting on May 2.</p> <p><u>NIST:</u> To prepare article for ICC/NFPA Journals on the need for regulation of</p> |

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| | | existing buildings. |
| <p>Recommendation 27. NIST recommends that building codes incorporate a provision that requires building owners to retain documents, including supporting calculations and test data, related to building design, construction, maintenance and modifications over the entire life of the building. Means should be developed for offsite storage and maintenance of the documents. In addition, NIST recommends that relevant building information be made available in suitably designed hard copy or electronic format for use by emergency responders. Such information should be easily accessible by responders during emergencies.</p> | <p><i>Model Building Codes:</i> Model building codes should incorporate this recommendation. State and local jurisdictions should adopt and enforce these requirements.</p> | <p><u>NIBS:</u> The NIBS/MMC committee concluded that problems exist because of ownership changes, the proprietary nature of some documents, determining what medium to use to save documentation, unreimbursable expense of maintaining information. It also was noted that only threat assessment documents need to be out of the public domain. The AHC-TRB submitted a code change proposal that includes some provisions for giving responders needed information by requiring that it be available in the command centers.</p> <p><u>NFPA:</u> The NFPA High Rise Building Safety Advisory Committee (HRBSAC) is considering a recommendation that building inventory plans be provided to or readily available to the first responders. NFPA is expected to brief the committee on its efforts related to this and other recommendations at the NIBS/MMC committee meeting on May 2.</p> |
| <p>Recommendation 28. NIST recommends that the role of the “Design Professional in</p> | <p><i>Affected Standards:</i> AIA Practice Guidelines. <i>Model Building Codes:</i> The</p> | <p><u>NIBS:</u> Selected NIBS Building Code Experts have been assigned to review the</p> |

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| <p>Responsible Charge” be clarified to ensure that: (1) all appropriate design professionals (including, e.g., the fire protection engineer) are part of the design team providing the standard of care when designing buildings employing innovative or unusual fire safety systems, and (2) all appropriate design professionals (including, e.g., the structural engineer and the fire protection engineer) are part of the design team providing the standard of care when designing the structure to resist fires, in buildings that employ innovative or unusual structural and fire safety systems.</p> | <p>IBC, which already defines the “Design Professional in Responsible Charge,” be clarified to address this recommendation. The NFPA 5000 should incorporate the “Design Professional in Responsible Charge” concept and address this recommendation.</p> | <p>issue with AIA and NIST. The committee plans to examine whether working with the National Council of Architectural Registration Boards and the National Council of Examiners for Engineering and Surveying would be helpful in implementing this recommendation.</p> <p><u>NFPA:</u> NFPA 5000 utilizes the term Registered Design Professional - RDP. Pending any clarifications that come out of the AIA-NIST effort, NFPA committees would be amenable to revisiting the use and description of this entity. NFPA is expected to brief the committee on its efforts related to this and other recommendations at the NIBS/MMC committee meeting on May 2.</p> |
| <p>Recommendation 29. NIST recommends that continuing education curricula be developed and programs be implemented for (1) training fire protection engineers and architects in structural engineering principles and design, and (2) training structural engineers, architects, fire protection engineers, and code enforcement officials in modern fire protection principles and technologies, including fire-resistance design of structures, and (3) training building regulatory and fire service</p> | <p><i>Affected Organizations:</i> AIA, SFPE, ASCE, ASME, AISC, ACI, and state licensing boards. <i>Model Building Codes:</i> Detailed criteria and requirements should be incorporated into the model building codes under the topic “Design Professional in Responsible Charge.”</p> | <p><u>NIST:</u> Plans to work with National Fire Academy and Emergency Management Institute to develop training resources.</p> |

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| <p>personnel to upgrade their understanding and skills to conduct the review, inspection, and approval tasks for which they are responsible.</p> | | |
| <p>Recommendation 30. NIST recommends that academic, professional short-course, and webbased training materials in the use of computational fire dynamics and thermostructural analysis tools be developed and delivered to strengthen the base of available technical capabilities and human resources.</p> | <p><i>Affected Organizations:</i> AIA, SFPE, ASCE, ASME, AISC, and ACI, ICC, NFPA.</p> | <p><u>NIST:</u> Plans to work with National Fire Academy and Emergency Management Institute to develop training resources.</p> |